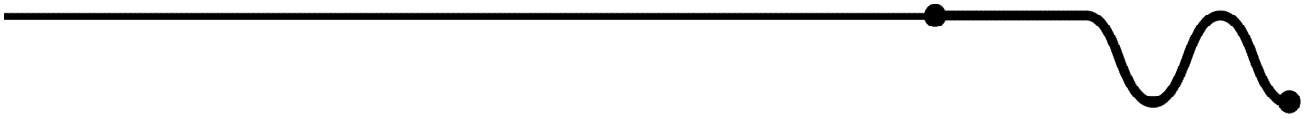
MTE
AN SL POWER ELECTRONICS COMPANY

480 Volts, 60HZ

USER INSTALLATION MANUAL



FORM: MAP-UIM-E
REL. March 2012
REV. 003
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IMPORTANT USER INFORMATION

NOTICE

The MTE Corporation Matrix® AP Harmonic Filter is designed for harmonic mitigation of 6-pulse inverter drives supplying variable torque loads in a wide variety of applications. The suitability of this filter for a specific application must therefore be determined by the customer. In no event will MTE Corporation assume responsibility or liability for any direct or consequential damages resulting from the use or application of this filter. Nor will MTE Corporation assume patent liability with respect to the use of information, circuits or equipment described in this instruction manual. The Matrix AP Harmonic Filter uses patented Adaptive Passive Harmonic Mitigating Reactor (AP HMR) technology to limit full load current distortion to less than 5% THID and 8% at 30% load.

MAPG0302D

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IMPORTANT SAFETY INFORMATION

WARNING

ONLY A QUALIFIED ELECTRICIAN CAN CARRY OUT THE ELECTRICAL INSTALLATION OF THIS FILTER

WARNING

High voltage is used in the operation of this filter. Use Extreme caution to avoid contact with high voltage when operating, installing or repairing this filter.

INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.

After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals. Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the scale used.

WARNING

The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the filter should be examined and replaced if damaged.

WARNING

An upstream disconnect/protection device must be used as required by the National Electrical Code (NEC) or governing authority.

IMPORTANT SAFETY INFORMATION, CONT.

WARNING

Even if the upstream disconnect/protection device is open, the drive down stream of the filter may feed back high voltage to the filter. The drive safety instructions must be followed.

INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED

WARNING

The filter must be grounded with a grounding conductor connected to all grounding terminals.

WARNING

Only spare parts obtained from MTE Corporation or an authorized MTE distributor can be used.

WARNING

Loose or improperly secured connections may damage or degrade filter performance. Visually inspect and secure all electrical connections before loading the filter.

Introduction

This manual was specifically developed to assist in the installation, interconnection and operation of the MTE Corporation Matrix AP Harmonic Filter.

This manual is intended for use by personnel experienced in the operation and maintenance of electronic drives. Because of the high voltages required by the filter and drive and the potential dangers presented by rotating machinery, it is essential that all personnel involved in the operation and maintenance of this filter know and practice the necessary safety precautions for this type of equipment. Personnel should read and understand the instructions contained in this manual before installing, operating or servicing the filter and the drive to which the filter is connected.

Upon Receipt of this Filter:

The MTE AP Harmonic Matrix Filter has been subjected to demanding factory tests before shipment. Carefully inspect the shipping container for damage that may have occurred in transit. Then unpack the filter and carefully inspect for any signs of damage. Save the shipping container for future transport of the filter.

In the event of damage, please contact and file a claim with the freight carrier involved immediately.

If the equipment is not going to be put into service upon receipt, cover and store the filter in a clean, dry location. After storage, ensure that the equipment is dry and that no condensation or dirt has accumulated on the internal components of the filter before applying power.

Repair/Exchange Procedure

MTE Corporation requires a Returned Material Authorization Number before it can accept any filters that qualify for return or repair. If problems or questions arise during installation, setup, or operation of the filter, please call the Director of Corporate Quality for assistance at:

Phone: 262-253-8200

FAX: 262-253-8222

Specifications:

Service Conditions

Load: 6-pulse variable torque rectifier only

Input voltage: 480 VAC +/- 10%, 60 ± 0.75 Hz, 3 phase

Input voltage line unbalance: 1% maximum

Maximum source impedance: 6.00%

Minimum source impedance: 1.5%

Service Factor: 1.00

Overload: 150 % for 1 minute duration with 10% output voltage reduction of nominal of voltage.

Ambient Temperature (Operating)

Enclosed Filters:	320A and Above:	-40 to +45 degrees C
	Below 320A:	-40 to +40 degrees C
Open Panel Filters:	-40 to +50 degrees C	
Storage Temperature:	-40 to +70 degrees C	

Altitude: 0 to 3300 Feet above sea level.

Relative Humidity: 0 to 95% non-condensing

Agency Approvals

UL and cUL listed to UL508 Type MX and CSA-C22.2 No 14-95
File E180243 (3 – 1000 HP, 120VAC through 600 VAC
50, 50/60, 60 Hz Three Phase

Notes (SCCR):

1. The Short Circuit Current Rating (SCCR) is not required under Exception No.1 of UL508A SB4.2.1 effective 4/25/06. This exception also applies to all the Contactor Options (002, 009, 012, and similar), where the Contactors are separated from the Main Power path by exempt components (such as Reactors) of sufficient Impedance, which is assured in case of the Reactors that are integral components of our Filter.

Performance

Total Harmonic Current Distortion:

8% MAX at 30% load, 5% MAX at FULL LOAD

Ratings

Watts loss

Table 1

Maximum Output Amps RMS	Efficiency (Typical) (%)	Power Dissipation @ Rated Current (Typical) (Watts)
83	99.1%	600
103	99.2%	702
128	99.0%	1,035
165	99.2%	1,096
208	99.2%	1,343
240	99.2%	1,514
320	99.4%	1,543
403	99.4%	1,932
482	99.5%	2,137
636	99.5%	2,509
786	99.6%	2,771
850	99.6%	3,163
1000	99.5%	4,206
1200	99.6%	4,400

Regulation table

Table 2

FILTER VOLTAGE REGULATION		480 VAC
MAXIMUM OUTPUT VOLTAGE AT NO LOAD	RMS PEAK	502 710
MINIMUM OUTPUT VOLTAGE AT FULL LOAD	RMS PEAK	460 600
*MAXIMUM PCC VOLTAGE WITH 6% SOURCE IMPEDANCE	RMS PEAK	490 693

Note: PCC is the point of common coupling with the power distribution system

Capacitor Currents

Table 3

Capacitor Current at Full Load	
Filter Current Rating Amps RMS	**Capacitor Current (Typical) Amps RMS**
83	29.2
103	34.7
128	39.8
165	53.2
208	64.8
240	72.7
320	94.5
403	132.3
482	141.8
636	195.6
786	245.0
850	265.9
1000	308.6
1200	355.2

Over Temperature Switch Ratings

Table 6

NC Switch opens at 180 Deg. +/- 5 deg C		
Current Amps	**Voltage**	**Contact Load**
6	120 AC	Resistive Loads
3	120 AC	Inductive Loads
3	240 AC	Resistive Loads
2.5	240 AC	Inductive Loads
8	12 VDC	Resistive Loads
4	24 VDC	Resistive Loads

Open Style Size and Weights

Table 4

Amps rating	Catalog Part Number	Total Weight Lbs.	HMR Size Inches	HMR Ref. Figure	Cap-Panel P.N.	Capacitor assemblies size Inches	Cap Ref. Figure
83	MAPP0083D	135	14"H X 12"W X 10.9"D	Figure 6	542	8.7"H X 5.6"W X 6.6"D	Figure 12
103	MAPP0103D	145	14"H X 12"W X 11.3"D	Figure 6	555	7.9"H X 16.3"W X 7.6"D	Figure 16
128	MAPP0128D	165	20"H X 15.25"W X 11.7"D	Figure 7	555	7.9"H X 16.3"W X 7.6"D	Figure 16
165	MAPP0165D	223	20"H X15.25"W X 12.75"D	Figure 7	557	7.9"H X 16.3"W X 7.6"D	Figure 16
208	MAPP0208D	237	20"H X 15.25"W X 12.75"D	Figure 7	545	7.9"H X 16.3"W X7.6"D	Figure 16
240	MAPP0240D	327	20"H X 15.25"W X 13.75"D	Figure 7	544	7.9"H X 16.3"W X 7.6"D	Figure 16
320	MAPP0320D	439	20"H X 15.25"W X 14.6"D	Figure 7	543	8.9" X 16.3"W X 7.6"D	Figure 16
403	MAPP0403D	433	23.25"H X 15.25"W X15.75"D	Figure 8	562	10.7" X 16.3" X 7.6"D	Figure 16
482	MAPP0482D	483	23.25"H X 15.25"W X15.75"D	Figure 8	544	7.9"H X 16.3"W X 7.6"D	Figure 16
					544	7.9"H X 16.3"W X 7.6"D	Figure 16
636	MAPP0636D	736	24.8"H X 24"W X 16"D	Figure 9	543	8.9" X 16.3"W X 7.6"D	Figure 16
					543	8.9" X 16.3"W X 7.6"D	Figure 16
786	MAPP0786D	911	25"H X 24"W X 17.5"D	Figure 9	562	10.7" X 16.3" X 7.6"D	Figure 16
					562	10.7" X 16.3" X 7.6"D	Figure 16
850	MAPP0850D	983	25"H X 24"W X 19.8"D	Figure 9	543	8.9" X 16.3"W X 7.6"D	Figure 16
					543	8.9" X 16.3"W X 7.6"D	Figure 16
					544	7.9"H X 16.3"W X 7.6"D	Figure 16
1000	MAPP1000D	1137	25"H X 20"W X 21.4"D	Figure 9	543	8.9" X 16.3"W X 7.6"D	Figure 16
					543	8.9" X 16.3"W X 7.6"D	Figure 16
					561	10.7" X 16.3" X 7.6"D	Figure 16
1200	MAPP1200D	1297	25"H X 24"W X 23.3"D	Figure 9	562	10.7" X 16.3" X 7.6"D	Figure 16
					562	10.7" X 16.3" X 7.6"D	Figure 16
					562	10.7" X 16.3" X 7.6"D	Figure 16

Enclosed Unit Size and Weights

Table 5

Filter Amps	NEMA 2	Enclosure	Weight	NEMA 3R	Enclosure	Weight	Figure
83	MAPG0083D	CAB-17AP2	230	MAPW0083D	CAB-17AP3	238	Figure 18
103	MAPG0103D	CAB-17AP2	313	MAPW0103D	CAB17-AP3	321	Figure 18
128	MAPG0128D	CAB-26AP2	333	MAPW0128D	CAB-26AP3	347	Figure 19
165	MAPG0165D	CAB-26AP2	392	MAPW0165D	CAB-26AP3	406	Figure 19
208	MAPG0208D	CAB-26AP2	405	MAPW0208D	CAB-26AP3	419	Figure 19
240	MAPG0240D	CAB-26AP2	489	MAPW0240D	CAB-26AP3	503	Figure 19
320	MAPG0320D	CAB-26APD2	630	MAPW0320D	CAB-26APD3	656	Figure 20
403	MAPG0403D	CAB-26APD2	673	MAPW0403D	CAB-26APD3	700	Figure 20
482	MAPG0482D	CAB-42AP2	702	MAPW0482D	CAB-42AP3	710	Figure 21
636	MAPG0636D	CAB-42AP2	1077	MAPW0636D	CAB-42AP3	1084	Figure 21
786	MAPG0786D	CAB-42AP2	1252	MAPW0786D	CAB-42AP3	1260	Figure 21
850	MAPG0850D	CAB-48AP2	1386	MAPW0850D	CAB-48AP3	1393	Figure 22
1000	MAPG1000D	CAB-48AP2	1640	MAPW1000D	CAB-48AP3	1647	Figure 22
1200	MAPG1200D	CAB-48AP2	1700	MAPW1200D	CAB-48AP3	1707	Figure 22

Note: Weight is shown in pounds

INSTALLATION INSTRUCTIONS

Matrix Filters are supplied in the following mechanical configurations:

Open Panel Mount

Floor mounted general purpose NEMA 2, & 3R cabinets,

Select a well-ventilated, dust-free area away from direct sunlight, rain or moisture. Do not install in or near a corrosive environment. Avoid locations where the filter would be subjected to excessive vibrations.

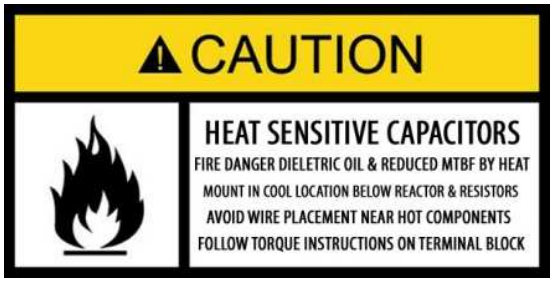
Panel mounted filters are designed for mounting in the vertical plane within the customer's enclosure. Panel mount units are made up of a Harmonic Mitigating Reactor (HMR) and one or more capacitor panel modules referred to as cap-panels on drawings and diagrams.

Mount the Harmonic Mitigating Reactor in a location where the ambient temperature does not exceed 50 degrees C. Allow a minimum side clearance of four (4) inches and a vertical clearance of six (6) inches for proper heat dissipation and access.

WARNING

Do not install capacitor assembly above/near the Harmonic Mitigating Reactor. Premature or catastrophic failure may occur.

The capacitor panel must be located in the lowest temperature regions of the enclosure - generally toward the bottom and away from high temperature components.


CAUTION
HEAT SENSITIVE CAPACITORS
FIRE DANGER DIELETRIC OIL & REDUCED MTBF BY HEAT
MOUNT IN COOL LOCATION BELOW REACTOR & RESISTORS
AVOID WIRE PLACEMENT NEAR HOT COMPONENTS
FOLLOW TORQUE INSTRUCTIONS ON TERMINAL BLOCK

Figure's 5 - 22 contain outline drawings for the various ratings and show mounting orientation with bolt patterns.

Include the power dissipation of the filter along with all the other components located in the enclosure to determine the internal temperature rise and cooling requirements of the enclosure.

General purpose NEMA 2, and 3R enclosed filters are designed for floor mounting in the vertical plane in an environment suitable for the enclosure type. Do not install in or near a corrosive environment. Avoid locations where the filter would be subjected to excessive vibrations. Allow a minimum side and back clearance of eight (8) inches and front clearance of thirty-six (36) inches for proper heat dissipation and access.

Refer to Article 430 Table 430.91 of the National Electrical code for the selection of the appropriate enclosure Type Number for your application.

AP HMR Bolt Hole Mounting Patterns

Table 8

Part Number	Lbs.	Overall Size	Rear Mount Centerline	Base Mount Centerline	Mounting Holes	Figure
MAPP0083D	133	15.7”H X 12”W X 10.7”D	11.96"A x 11"B	6.5”C X 11”E	.340” DIA	Figure 6
MAPP0103D	144	15.7”H X 12”W X 11.1”D	12.05'A x 11"B	6.5”C X 11”E	.340” DIA	Figure 6
MAPP0128D	149	20”H X 15.25”W X 11.7”D	17.37”A X 14”B	6”C X 14”E	.413” DIA	Figure 7
MAPP0165D	257	20”H X15.25”W X 12.75”D	17.32”A X 14”B	7”C X 14”E	.413” DIA	Figure 7
MAPP0208D	270	20”H X 15.25”W X 12.75”D	17.47”A X 14”B	7”C X 14”E	.413” DIA	Figure 7
MAPP0240D	310	20”H X 15.25”W X 13.75”D	17.51”A X 14”B	8”C X 14”E	.413” DIA	Figure 7
MAPP0320D	397	20”H X 15.25”W X 14.6”D	17.55”A X 14”B	10”C x 14”E	.413” DIA	Figure 7
MAPP0403D	433	23.25”H X 15.25”W X14.82”D	20.64”A X 14”B	9.2”C x 14”E	.413” DIA	Figure 8
MAPP0482D	483	23.3”H X 15.25”W X15.80”D	20.60”A X 14”B	10.06”C X 14”E	.413” DIA	Figure 8
MAPP0636D	793	24.8”H X 24”W X 16”D	N/A	9.15”C X 22”E	1” DIA	Figure 9
MAPP0786D	970	25”H X 24”W X 17.5”D	N/A	10.65”C X 22”E	1” DIA	Figure 9
MAPP0850D	1070	25”H X 24”W X 19.8”D	N/A	10.65”C X 22”E	1” DIA	Figure 9
MAPP1000D	1213	25”H X 20”W X 21.4”D	N/A	12.15”C X 22”E	1” DIA	Figure 9
MAPP1200D	1365	25”H X 24”W X 23.3”D	N/A	13.65”C X 22”E	1” DIA	Figure 9

Use the above table and referenced figures to establish suitable reactor mounting.

Cap-panel Bolt Hole Mounting Patterns

Table 9

Part Number	CAP P.N.	Cap-panel Weight Lbs.	Overall Size	Rear Mount Centerline	Mounting Holes	Figure
MAPP0083D	542	3.75	8.7"H X 5.6"W X 6.6"D	5.06"A X 5.06"B	.218" DIA	Figure 12
MAPP0103D	555	16	6.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0128D	555	16	6.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0165D	557	16	6.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0208D	545	18	7.9"H X 16.3"W X7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0240D	544	18	7.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0320D	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0403D	562	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0482D	544	18	7.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	544	18	7.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0636D	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0786D	562	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	562	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP0850D	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	544	18	7.9"H X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP1000D	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	543	20	8.9" X 16.3"W X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	561	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
MAPP1200D	562	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	562	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16
	562	23	10.7" X 16.3" X 7.6"D	3.77"A x 15.81"B	.280" DIA	Figure 16

Note: Units above 403 amps require multiple parallel cap panels
Use the above table and referenced figures to establish suitable Cap-panel mounting

AP HMR MOUNTING & TERMINAL LOCATIONS

AP HMR 83 - 103 Amp

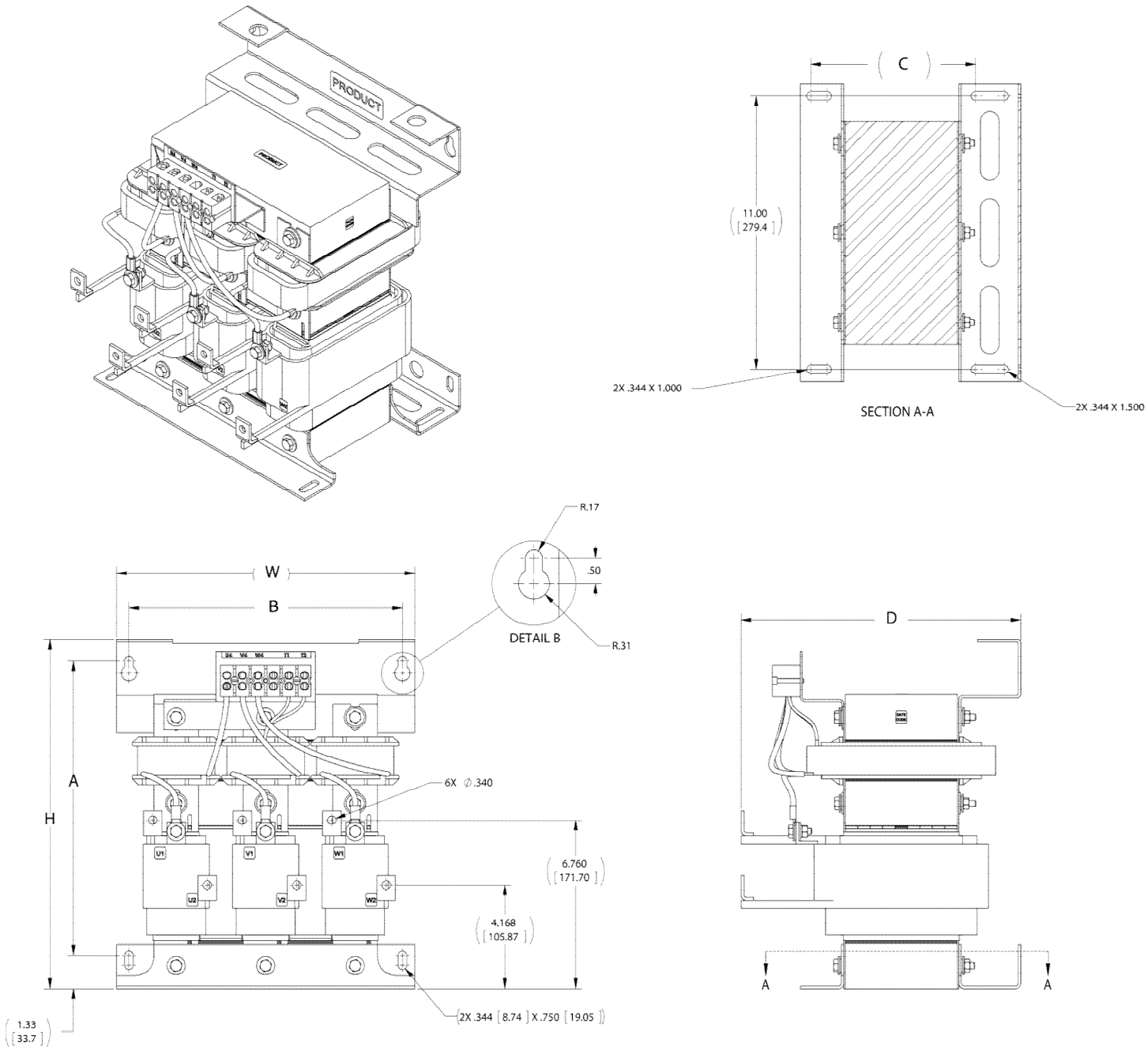


Figure 6 83 – 103 AMP

AP HMR MOUNTING & TERMINAL LOCATIONS

AP HMR 128 - 320 Amp

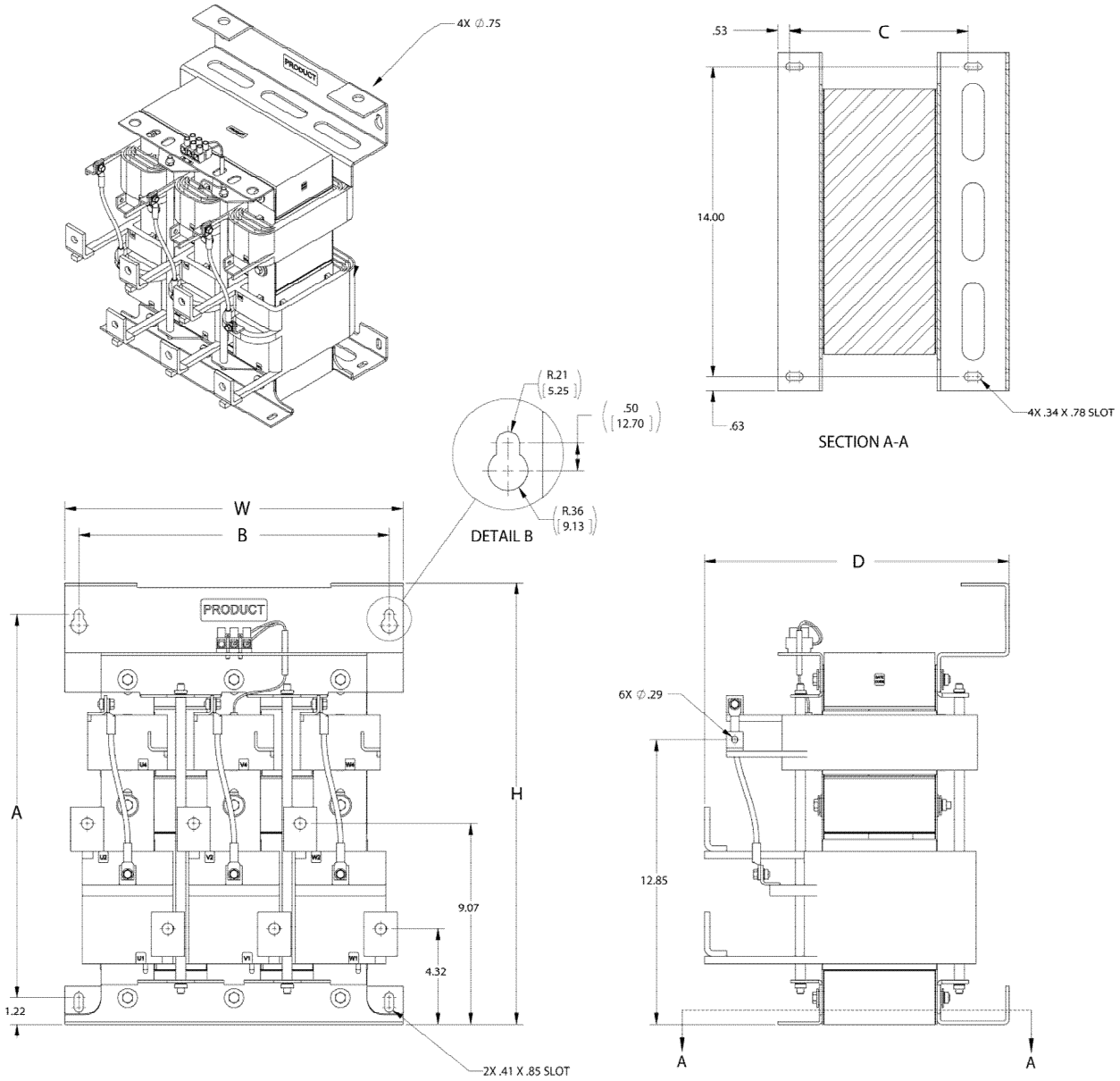


Figure 7 128 – 320 AMP

AP HMR MOUNTING & TERMINAL LOCATIONS

AP HMR 403 - 482 Amp

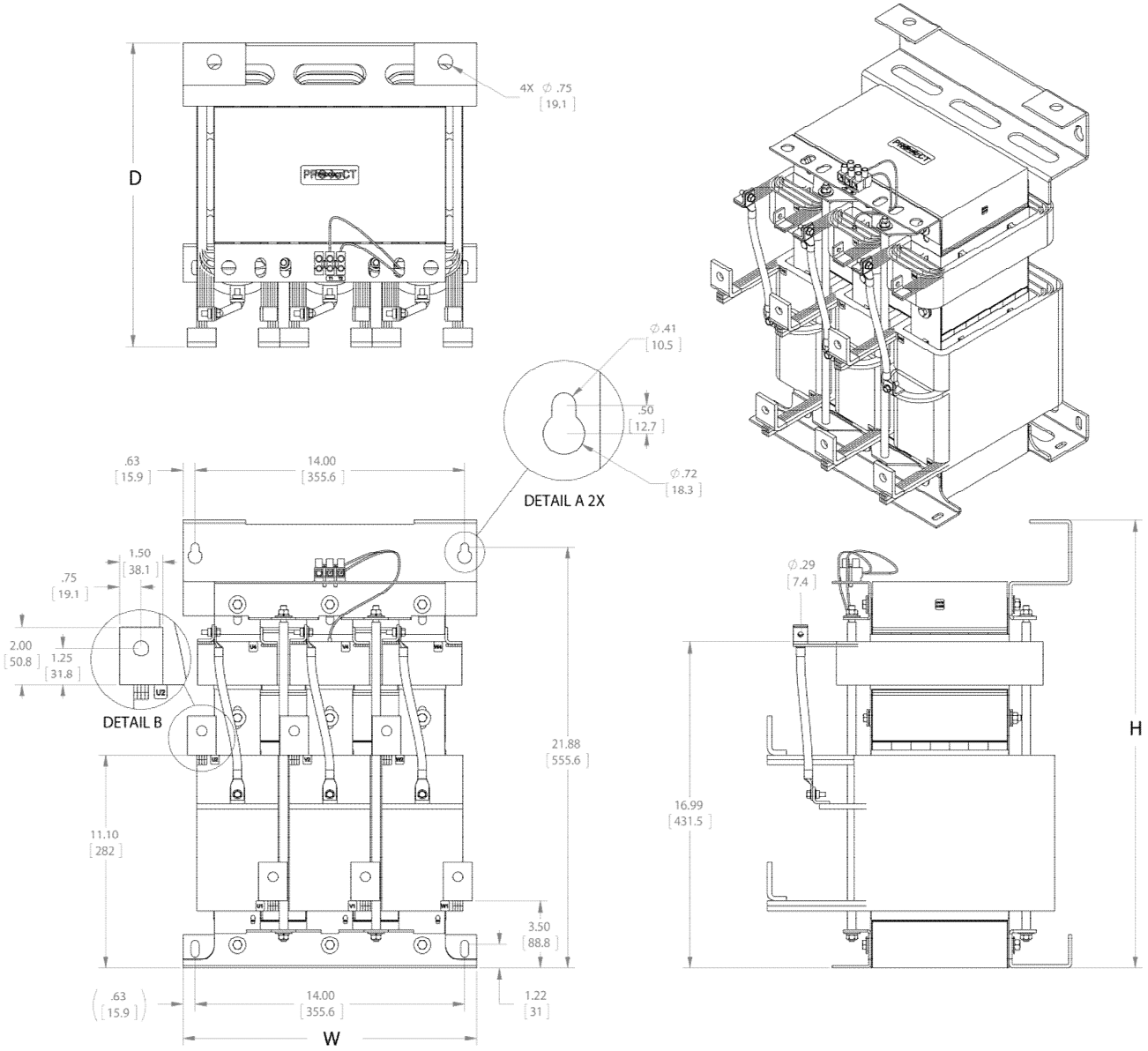


Figure 8 403 – 482 AMP

AP HMR MOUNTING & TERMINAL LOCATIONS

AP HMR 636 - 1200 Amp

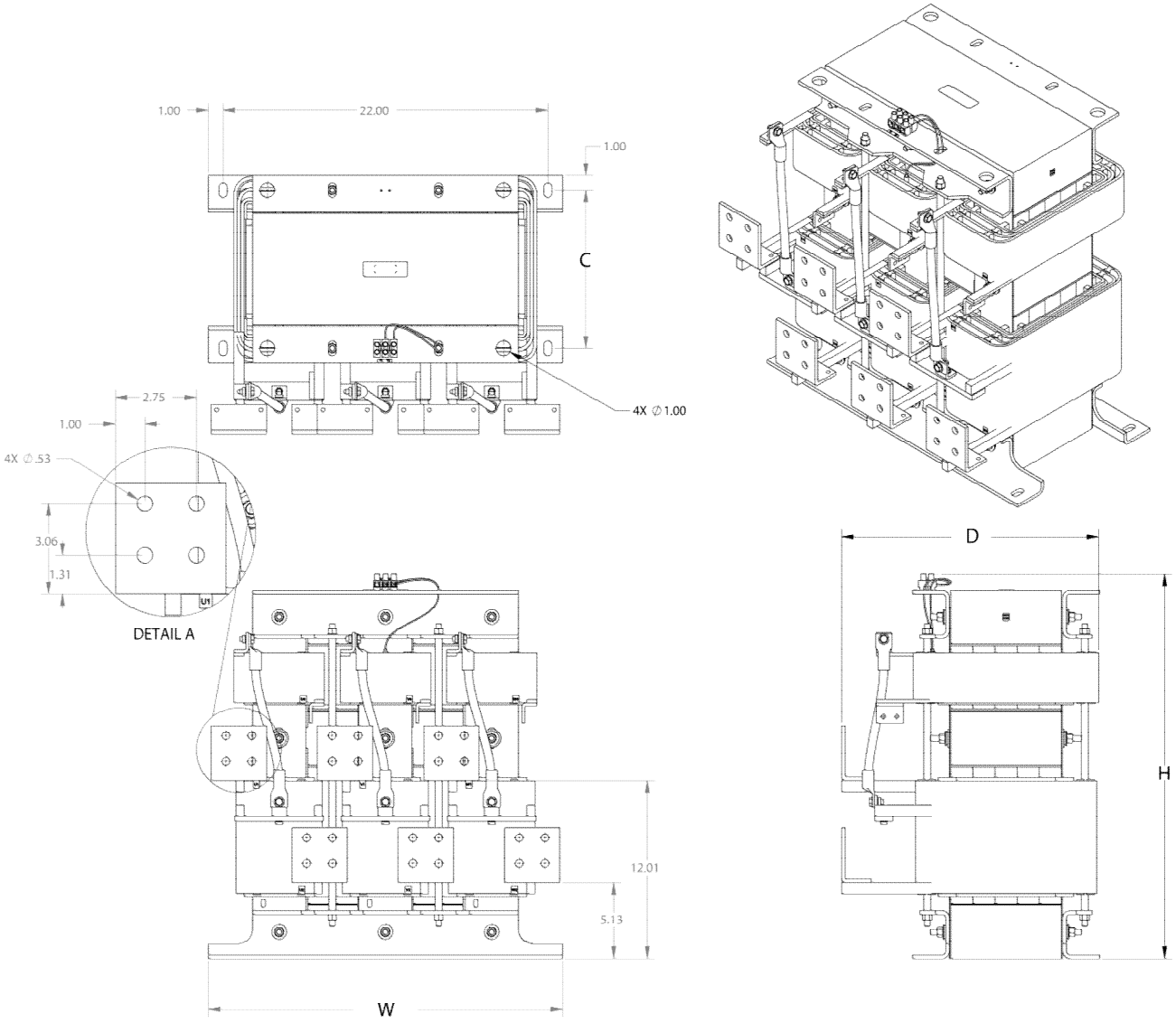


Figure 9 636 – 1200 AMP

CAP-ASSEMBLY MOUNTING & TERMINAL LOCATIONS

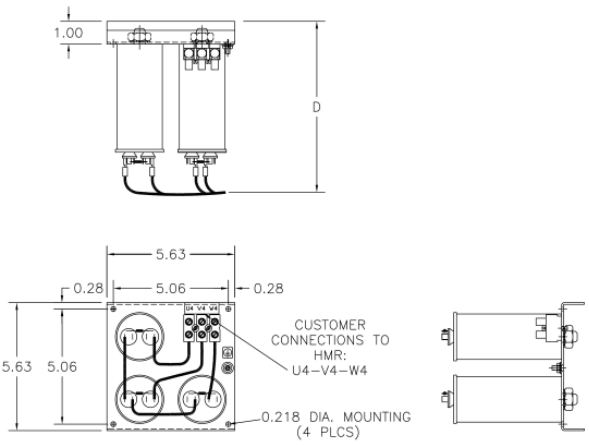


Figure 12 3 Caps

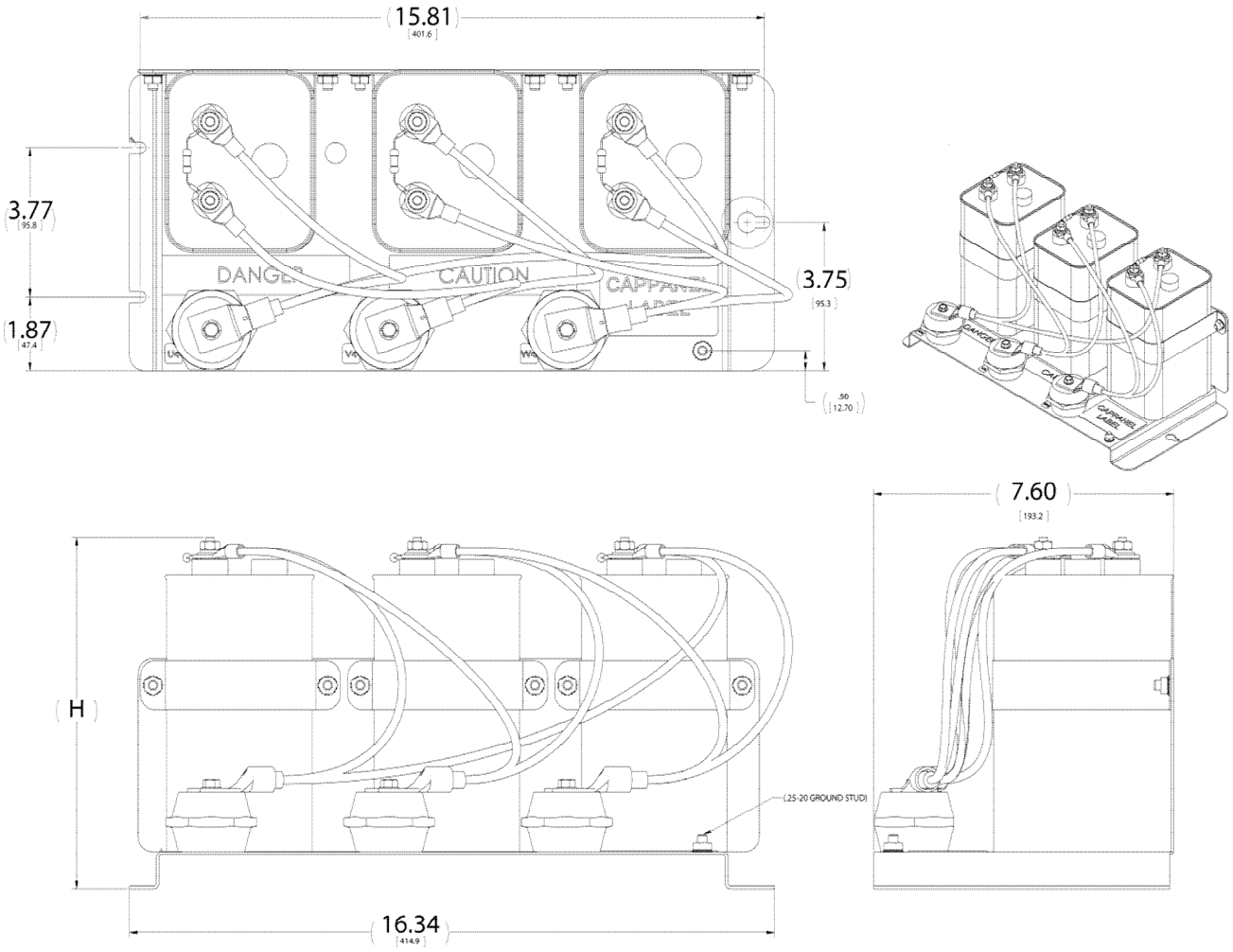


Figure 16 3 – High Current Capacitor Panel

Note: Height of capacitors will vary depending on the size of the filter.

ENCLOSED UNIT INTERNAL DETAILS & TERMINAL LOCATIONS

CAB-17AP 83-103 AMPS

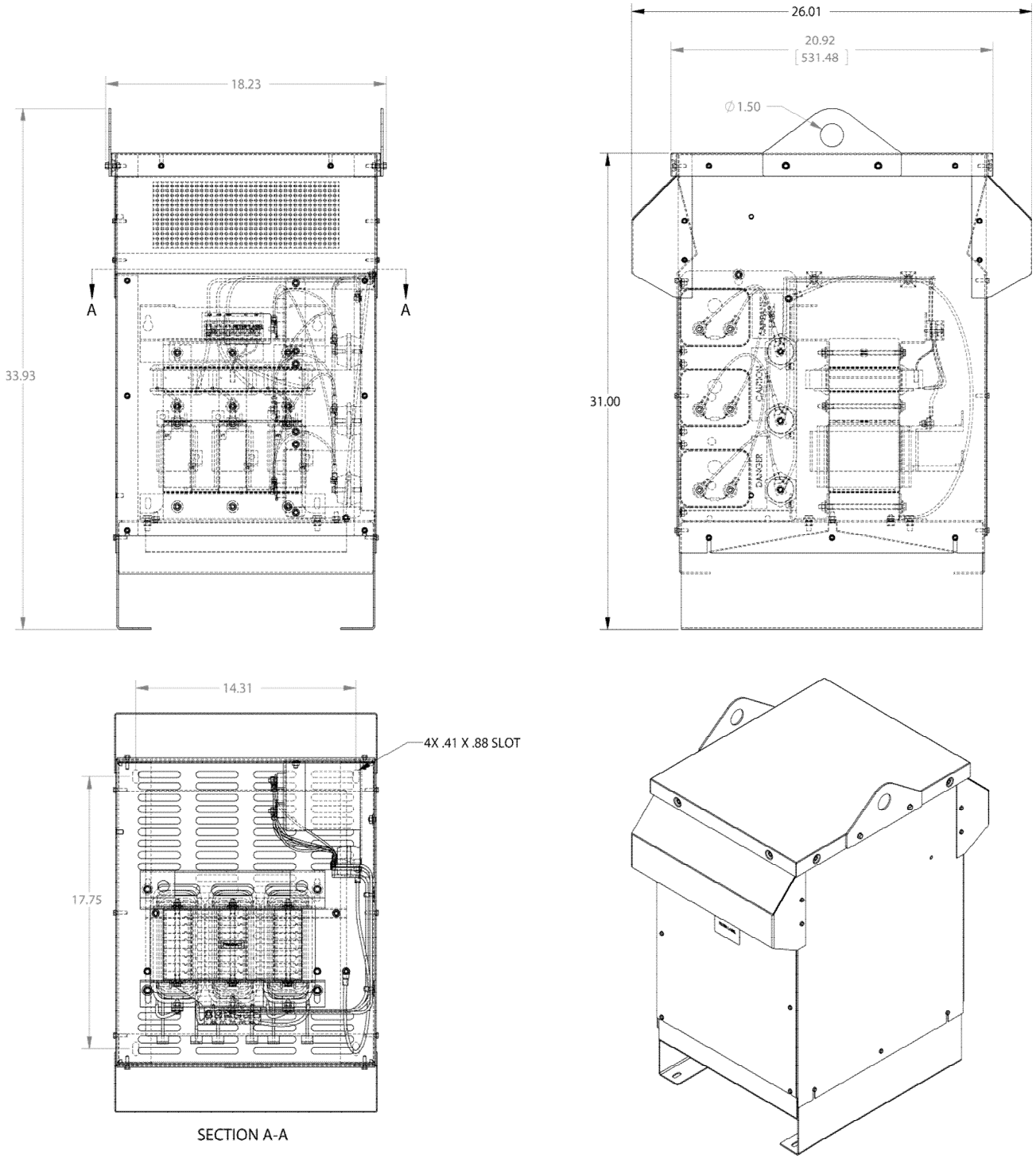


Figure 18 83-103 AMP

Refer to the MTE website, www.mtecorp.com, for Detailed Specifications
Capacitor placement shown for illustrative purposes only

ENCLOSED UNIT INTERNAL DETAILS & TERMINAL LOCATIONS

CAB-26AP 128-240 AMPS

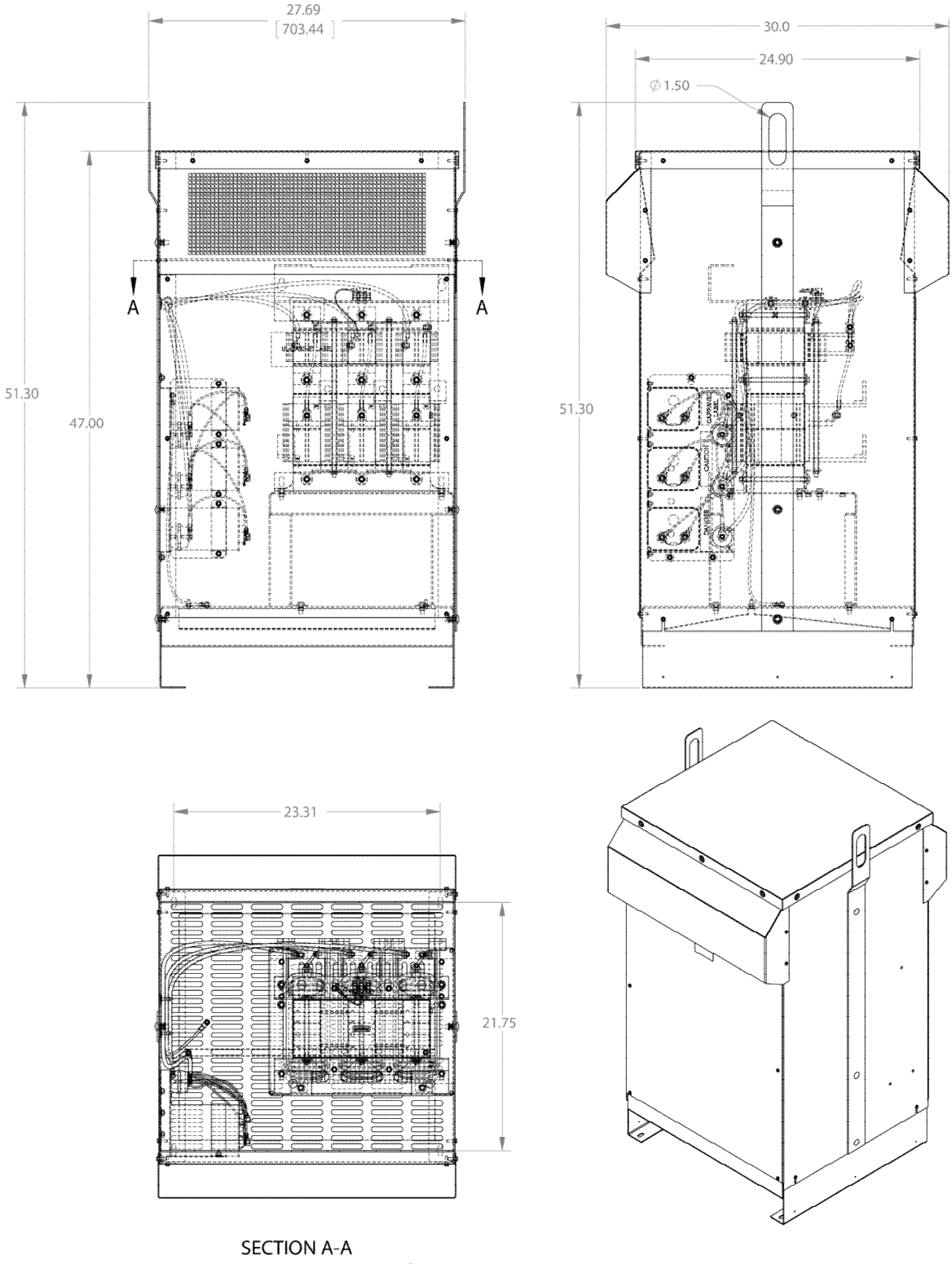


Figure 19 128-240 AMP

Refer to the MTE website, www.mtecorp.com, for Detailed Specifications

ENCLOSED UNIT INTERNAL DETAILS & TERMINAL LOCATIONS

CAB-26APD 320-403 AMPS

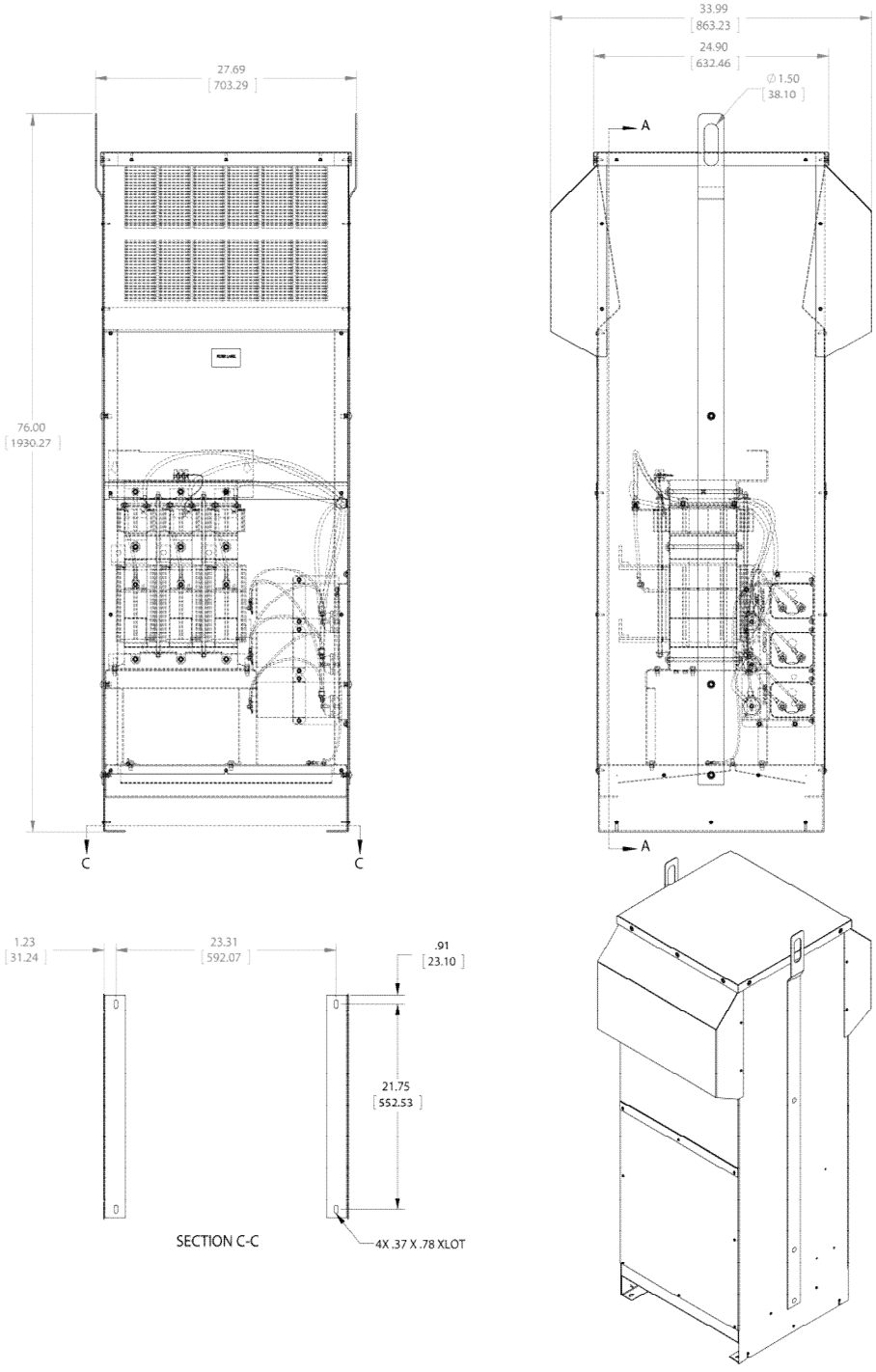


Figure 20 320-403 AMP

Refer to the MTE website, www.mtecorp.com, for Detailed Specifications

ENCLOSED UNIT INTERNAL DETAILS & TERMINAL LOCATIONS

CAB-42AP 482-786 AMPS

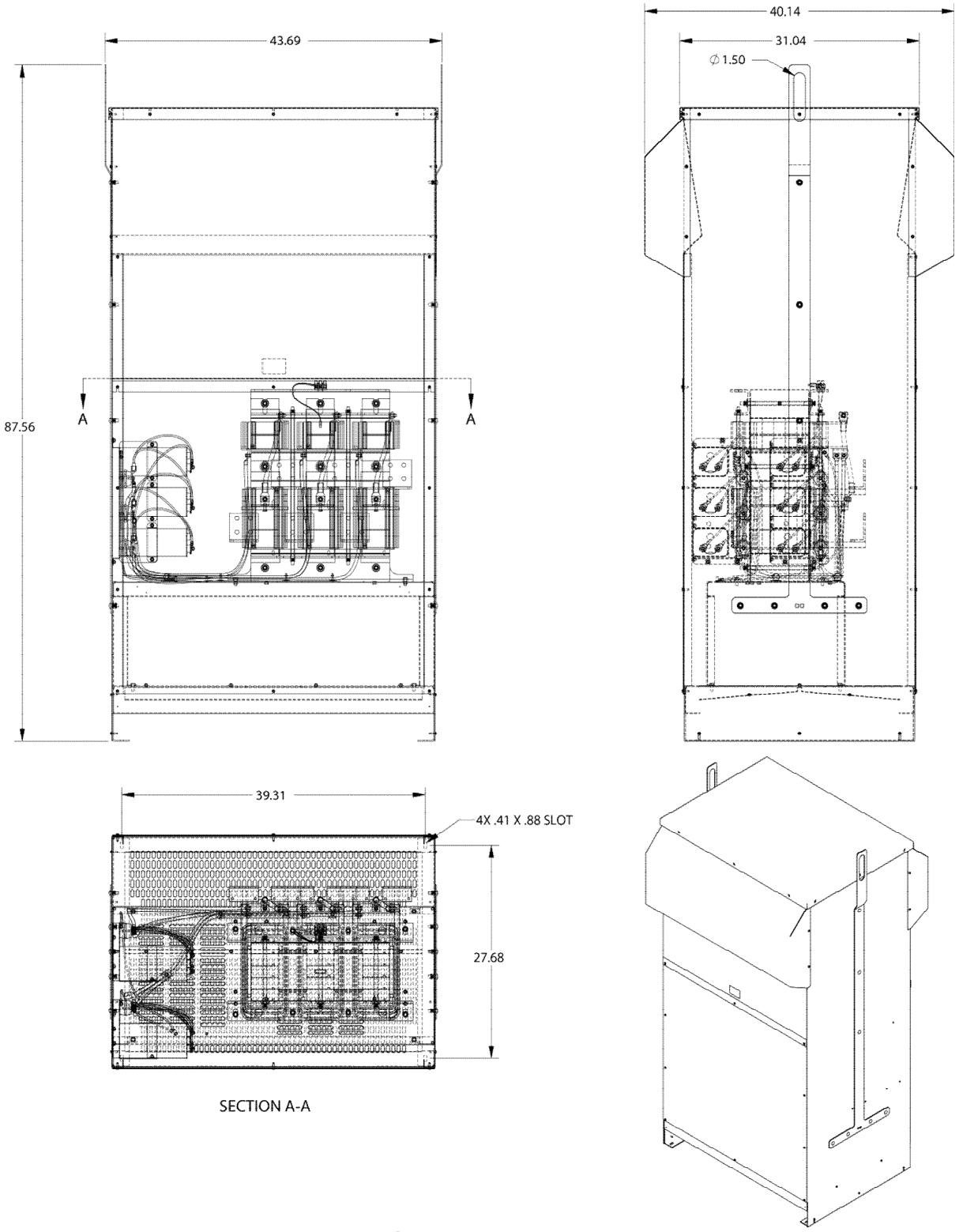


Figure 21 482-786 AMP

Refer to the MTE website, www.mtecorp.com, for Detailed Specifications

ENCLOSED UNIT INTERNAL DETAILS & TERMINAL LOCATIONS

CAB-48AP 850-1200 AMPS

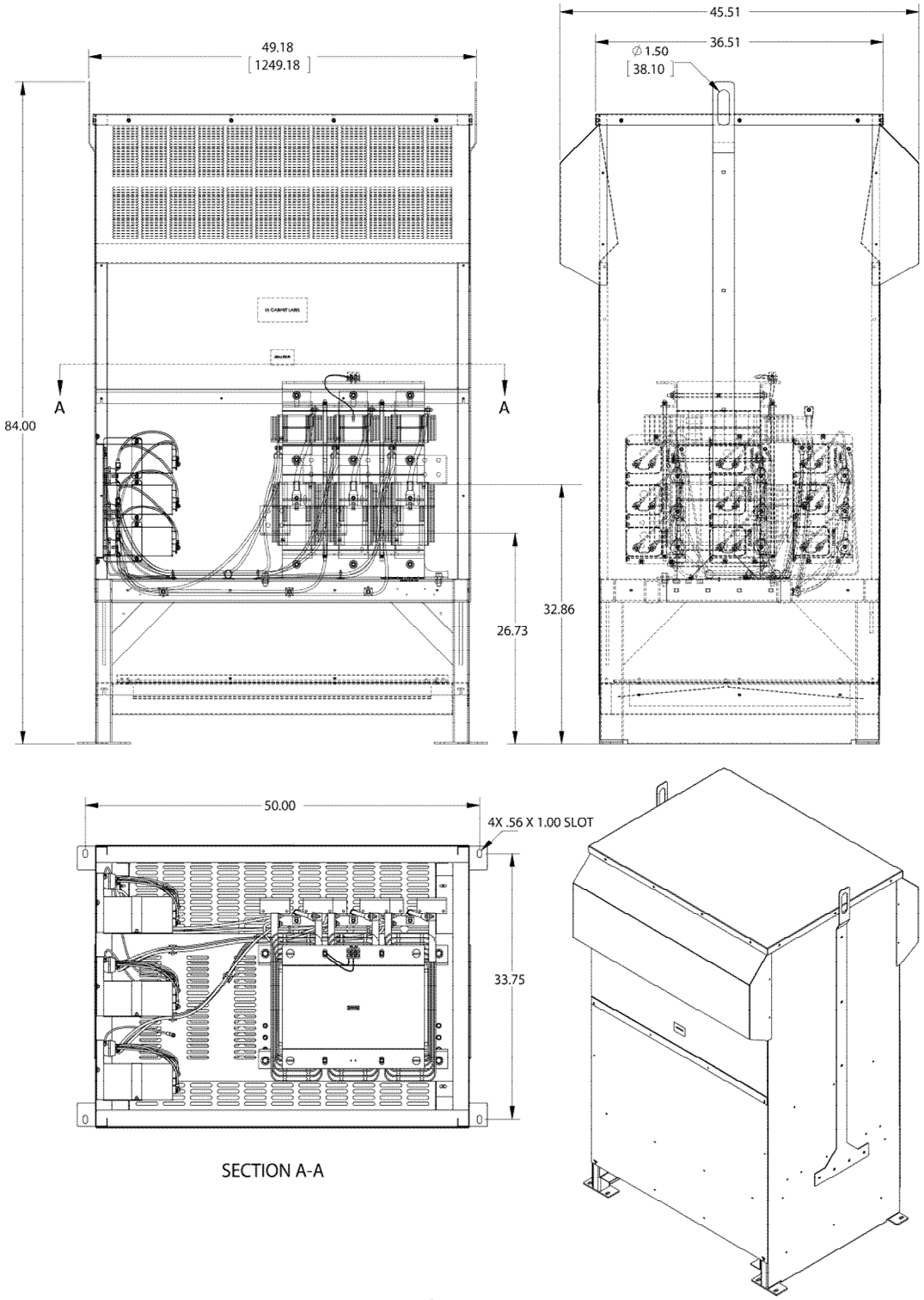


Figure 22 850 - 1200 AMP

Refer to the MTE website, www.mtecorp.com, for Detailed Specifications

Power Wiring Connection

WARNING

Input and output power wiring to the filter should be performed by authorized personnel in accordance with the NEC and all local electrical codes and regulations. Cable lugs and mounting hardware are provided by the customer.

Verify that the power source to which the filter is to be connected is in agreement with the nameplate data on the filter. A fused disconnect switch or circuit breaker should be installed between the filter and its source of power in accordance with the requirements of the NEC and all local electrical codes and regulations. Refer to the drive user manual for selection of the correct fuse rating and class.

The filter is suitable for use on a circuit capable of delivering not more than 100K RMS symmetrical amperes at 480 volts maximum when protected by type J, T or RK1 class fuses or a circuit breaker having a interrupting rating not less than 100K RMS symmetrical amperes, 480 volts maximum.

For panel mounted filter applications interconnection between the filter, its power source the cap-panels and the drive is shown in Figure 24. Table 10 lists the wire range and terminal torque requirements as a function of filter current ratings. Use table 10 for selecting conductors that interconnect the HMR and capacitor assemblies. Filters that use multiple cap-panels share total cap current shown on table 3.

Refer to the drive user manual for instructions on interconnecting the drive and motor and the correct start-up procedures for the drive.

The filter is designed for use with copper conductors with a minimum temperature rating of 75 degrees C.

For filters supplied in general purpose NEMA, 2 & 3R cabinets, interconnection between the filter, its power source, and the drive is shown in Figure 25. Refer to Figures 5 to 10 for the location of input, output, ground, and over temperature switch terminals. Table 10 lists the wire range and terminal torque requirements as a function of filter current ratings. Refer to the drive user manual for instructions on interconnecting the drive and motor and the correct start-up procedures for the drive.

Wiring checks

Using Figure 27 visually check the wired components for wiring errors then with a multi meter check phase to phase isolation using the 100 K ohm range. The multi meter will read the parallel equivalent of the bleeder resistors after the capacitors initially charge. All phase to phase resistance values should be the same.

WARNING

Any extremely low or high resistance readings indicate a mis-wire and may result in damage to filter components if not corrected.

Check for the following faults:

Capacitor shorted
Capacitor bus not connected
Capacitor bus to chassis short
Paralleling wiring errors

Power Wiring Connection, Cont.

Grounding and Ground Fault Protection

The filter must always be grounded with a grounding conductor connected to all ground terminals.

Due to high leakage currents associated with variable frequency drives, ground fault protective devices do not necessarily operate correctly when placed ahead of a Matrix Filter feeding a drive. When using this type of device, its function should be tested in the actual installation.

Over Temperature Switch

The temperature switch is provided to annunciate adverse filter heating. Damage to the filter or drive may be avoided by interlocking this switch to shut down the drive or illuminate a service light; see figures 24 and 25 for connection diagrams. Read the vendor drive manual for details in using interlock inputs.

Input and Output Terminal Specifications

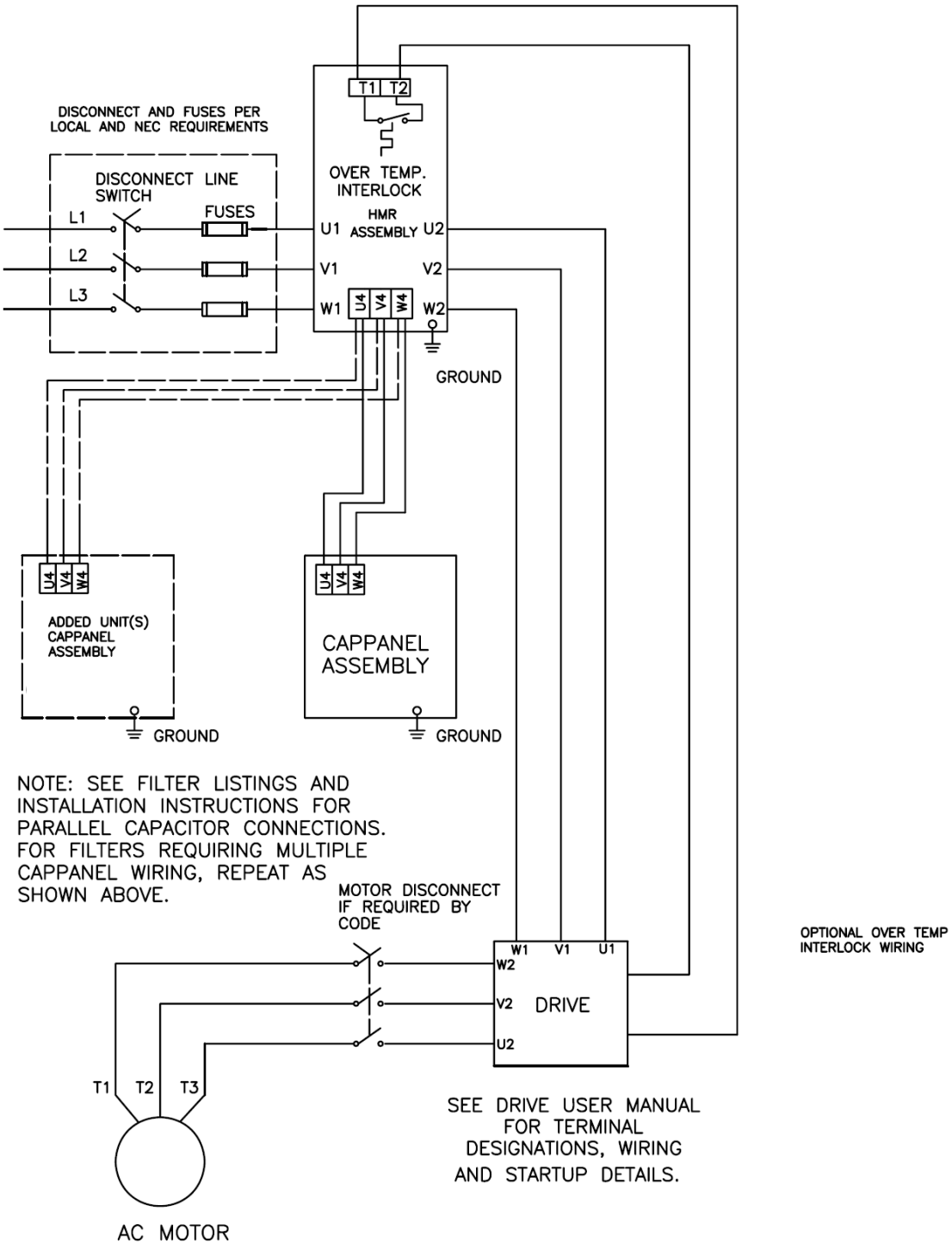
Table 10

Filter Rating (Amps)	AP HMR Terminals			Cap-panel Terminals U4-V4-W4		
	Input /Output Power U1-V1-W1 / U2-V2-W2		U4-V4-W4 interconnect cappanel	CAPPANEL Part Number	Minimum Interconnect Wire Gauge (AWG)	Terminal Torque (in-lbs.)
	Wire Range (AWG)	Terminal Torque (in-lbs.)	Terminal Torque (in-lbs.)			
83	Flat copper tab	N/A	16	542	10	35
103	Flat copper tab	N/A	16	555	8	60
128	Flat copper tab	N/A	N/A	555	8	60
165	Flat copper tab	N/A	N/A	557	6	60
208	Flat copper tab	N/A	N/A	545	4	60
240	Flat copper tab	N/A	N/A	544	4	60
320	Flat copper tab	N/A	N/A	543	2	60
403	Flat copper tab	N/A	N/A	562	1/0	60
482	Flat copper tab	N/A	N/A	544	4	60
			N/A	544	4	60
636	Flat copper tab	N/A	N/A	543	2	60
			N/A	543	2	60
786	Flat copper tab	N/A	N/A	562	1/0	60
			N/A	562	1/0	60
850	Flat copper tab	N/A	N/A	543	2	60
				543	2	60
				544	4	60
1000	Flat copper tab	N/A	N/A	543	2	60
				543	2	60
				561	2	60
1200	Flat copper tab	N/A	N/A	562	1/0	60
				562	1/0	60
				562	1/0	60

Note: Cap-panel interconnect wiring specification according to UL508 75° C Table.
Note: To prevent flexing or bending of the coil windings attached to APHM R Flat copper terminal tabs, use two wrenches to tighten customer provided cable mounting hardware.

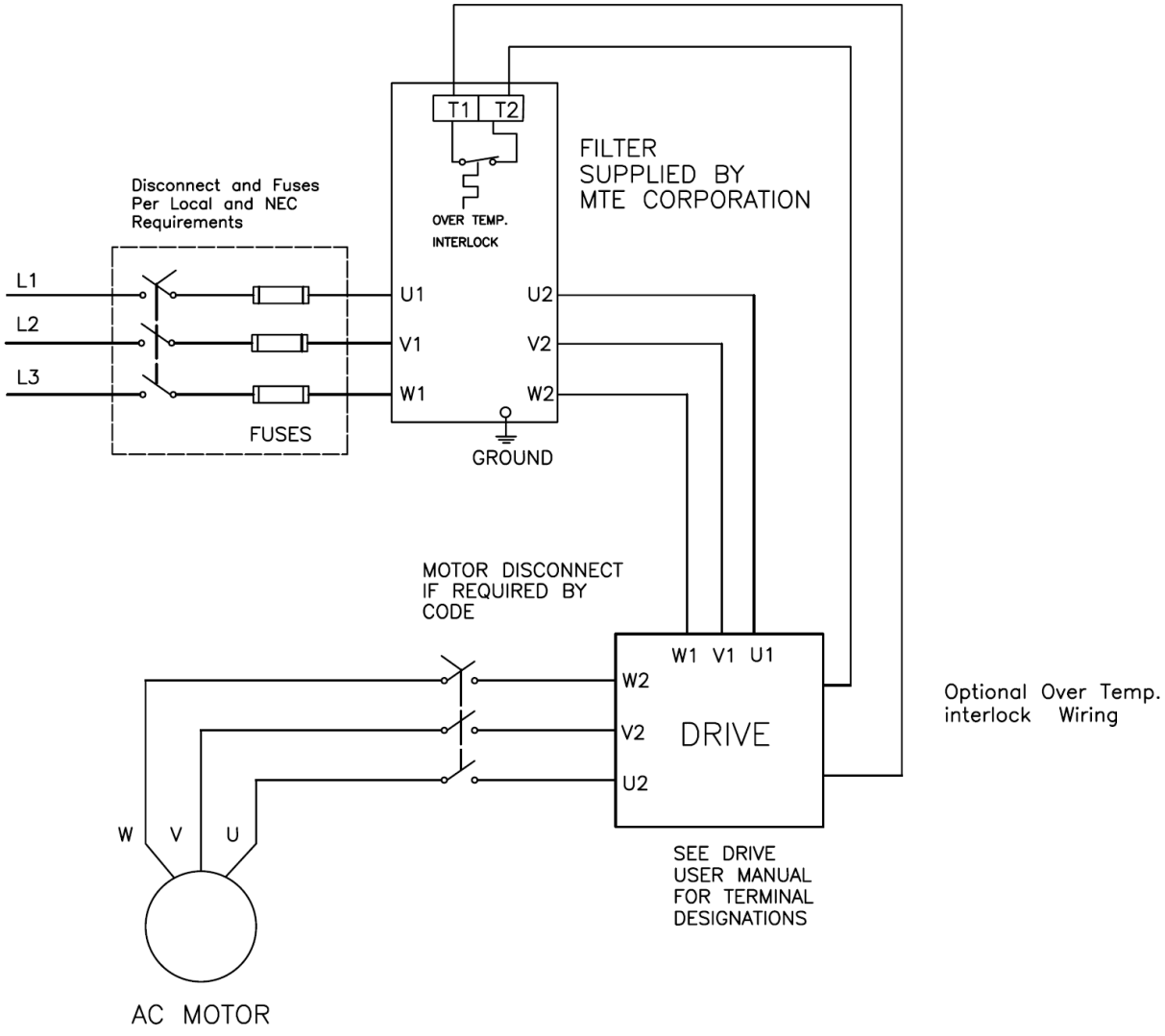
Open Panel Unit Interconnection Diagram

Figure 24



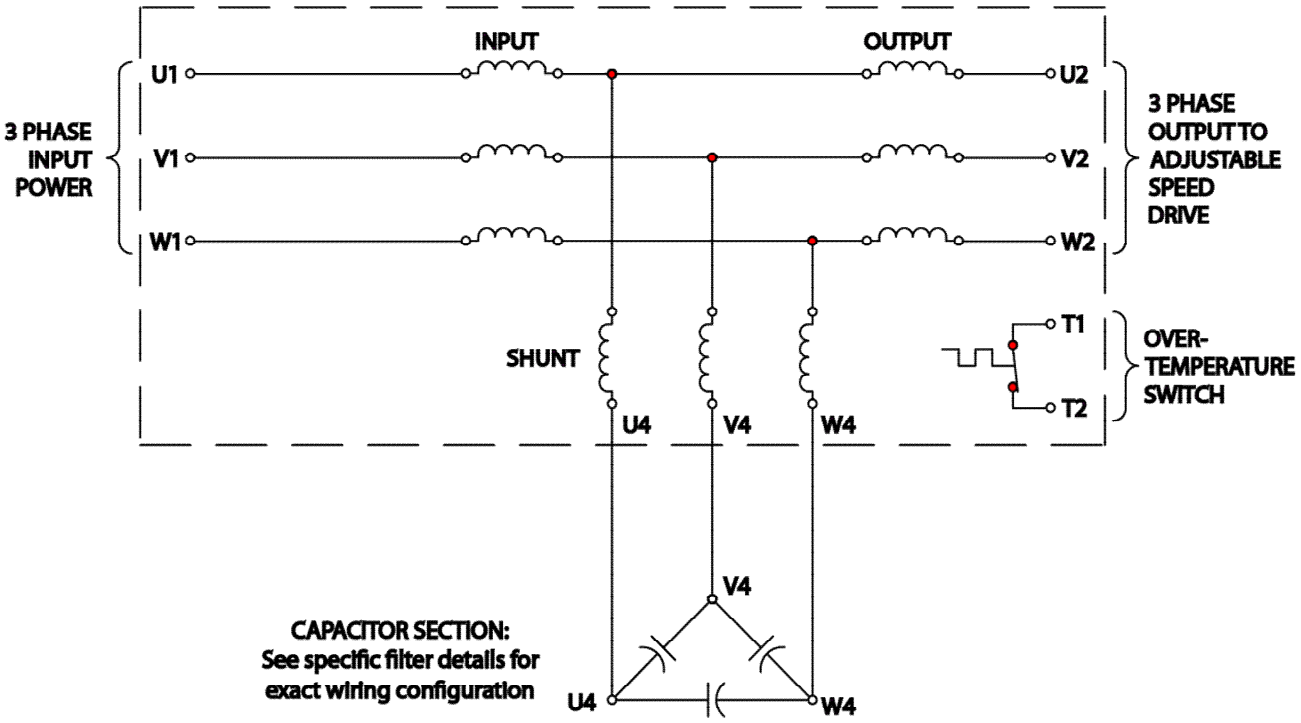
Enclosed Unit Interconnection Diagram

Figure 25



Matrix AP Basic Schematic Diagram

Figure 27



STARTUP

Safety Precautions

Before startup, observe the following warnings and instructions:

WARNING

Internal components of the filter are at line potential when the filter is connected to the utility. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it.

WARNING

After disconnecting the utility power, wait at least 5 minutes before doing any work on the filter connections. After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals. Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the scale used.

Sequence of Operation

1. Read and follow safety precautions.
2. After installation, ensure that:
   - All filter ground terminals are connected to ground.
   - Power wiring to the utility, drive and motor is in accordance with the power wiring connection diagrams shown in installation instructions section. Use the guidelines of table 10 for power and cap-panel wire gauges.
3. Check that moisture has not condensed on the filter components. If moisture is present, do not proceed with startup until the moisture has been removed.
4. Disconnect the filter output from the drive.
5. Connect the filter to the utility.

WARNING

Use extreme caution to avoid contact with line voltage when checking for power. INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.

6. Confirm that line voltage is present at the input terminals (U, V1, W1) of the filter.
7. Confirm that line voltage is present at the output terminals (U2, V2, W2) of the filter and that it is less than or equal to 1.05 times the input voltage.
8. Using a clamp on Amp meter, check input phase currents to verify they are within a 5% match to each other. Use 70% of the values from Table 3.
9. Remove power and verify **that NO VOLTAGE** is present on the filter terminals.
10. Connect the filter output to the drive.
11. Refer to the drive user manual for the drive startup procedure. Observe all safety instructions in the drive user manual.

WARNING

INJURY OR DEATH MAY RESULT IF THE DRIVE SAFETY PRECAUTIONS ARE NOT OBSERVED. DAMAGE TO EQUIPMENT MAY OCCUR IF THE DRIVE STARTUP PROCEDURES ARE NOT OBSERVED.

TROUBLESHOOTING

WARNING

When properly installed, this equipment has been designed to provide maximum safety for operating personnel. However, hazardous voltages exist within the confines of the enclosure. Servicing should therefore be performed by qualified personnel only and in accordance with OSHA Regulations.

To aid in troubleshooting, a schematic diagram is shown in Figure 27 and a list of potential problems and solutions are listed below.

WARNING

High voltage is used in the operation of this filter. Use Extreme caution to avoid contact with high voltage when operating, installing or repairing this filter. INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.

After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals. Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the scale used.

Troubleshooting, Cont.

MTE Matrix AP Harmonic Filter Field Checks

1. Read and understand the voltage appropriate MTE Matrix user manual. These manuals may be downloaded from the ***www.mtecorp.com*** web site. Locate figures and drawings for your particular filter and identify the terminals locations.
2. Disconnect all power and remove input power wiring from U1, V1, W1 terminals.
3. Remove VFD drive power connections from filter terminals U2, V2, W2 and any contactor or temperature switch wiring. (For filters having control transformers: remove power fuses on top of transformer.)
4. Visually inspect filter terminals and wiring lugs for signs of heat and corrosion. ***Contact factory if any wires appear to be missing or cut!***
5. Inspect the U4, V4, W4 capacitor interconnect terminals and wiring.
6. Visually inspect all capacitors for signs of case deformation bowing of the top, leaking oil or terminal damage. Note the CAP- # and date code of any damaged capacitors.
7. Using a multi meter set to read 100K ohms check:
    a. Phase to phase U1-V1-W1-U1 (mechanically activate contactor if present) after reactor and caps charge reading should be about 40K (total equivalent breeder resistance value) and should be the same for each phase. Open circuit or very low readings indicate a problem.
    b. Phase to chassis U1- case, V1-case, W1- case; low readings indicate a ground fault problem.
8. Ensure the “disconnect” is safe then wire the utility power to U1, V1, W1.
9. Apply power and verify that proper output voltage is present on U2, V2, and W2.
10. Using a clamp on amp meter read the filter input current:
    a. Readings will be 0.5 of the capacitor current listed in table 3 for the listed filter current in the user manual (mechanically activate the contactor if the filter is equipped with one). Readings should be the same (+/- 5%) for all phase currents; ***contact the factory if currents are out of tolerance!***
    b. Open contactor readings will show zero current for all phases.
11. Disconnect filter power and wire the VFD to U2, V2, and W2 as well as any control wiring to the filter contactor or temperature switch. Replace any control transformer fuses. Follow the drive power startup guidelines in the drive manufactures user manual.

PROBLEM:	**Line voltage is not present at the filter output terminals.**
Possible cause:	Power to the filter is turned off.
Solution:	Turn power on.
Possible cause:	One or more external line fuses are blown.
Solution:	Verify the continuity of line fuses in all phases. Replace as necessary.

PROBLEM:	**Full Load Harmonic current distortion exceeds 5% on one or more phases at full load.**
Possible cause:	The capacitor assembly has not been connected.
Solution:	Check interconnection of capacitor assembly with AP HMR (Figure 19 & 20).
Possible cause:	A capacitor has failed.
Solution:	Inspect the tops of all capacitors for bowing. Replace failed capacitors.
Possible cause:	Source impedance is less than 1.5%.
Solution	Add a minimum 1.5% impedance line reactor to the filter input
Possible cause:	Input source voltage harmonic distortion.
Solution	Identify equipment causing harmonic voltage distortion and add filters as required or accept elevated THVD
Possible cause:	Line voltage unbalance exceeds 1%.
Solution:	Balance input line voltage to 1% or less.

PROBLEM:	**Filter output voltage is not within specification**
Possible cause:	Filter input voltage is not within specification.
Solution:	Check the AC input line voltage and verify that it is within tolerance. Refer to the filter service conditions and performance specifications for tolerances.
Possible cause:	Source impedance is out of tolerance.
Solution:	Verify that the source impedance is within tolerance. Refer to the filter service conditions and performance specifications for tolerances.
Possible cause:	One or more Capacitors is damaged
Solution:	Visually check capacitor top for distortion or doming check for shorts or open caps.
Possible cause:	Drive set up parameters do not allow for input filter
Solution:	Consult drive manufacturer to update setup to accommodate input filter
Possible cause:	Input voltage subject to extreme transients such as switching between two voltage sources. Drive faults on over or under voltage.
Solution:	Source switching is not recommended without proper phase synchronizing or allowing reasonable time delay before transfer to new source.